

XVI. "On the Nephridia and 'Liver' of *Patella vulgata*." By A. B. GRIFFITHS, Ph.D., F.R.S. (Edin.), F.C.S. (Lond. and Paris), Principal and Lecturer on Chemistry and Biology, School of Science, Lincoln. Communicated by Sir RICHARD OWEN, K.C.B., F.R.S. Received May 20, 1887.

Patella vulgata (Limpet), with its conical shell adhering to the rocks of our coasts, is well known to every sea-side wanderer. This member of the Gasteropoda has been the subject of many scientific memoirs in ancient and modern times. Amongst naturalists, Aristotle was the earliest who gave an account of some of the limpet's habits, and Cuvier was the first to describe its anatomy. In this paper the author intends to describe the chemical properties of the secretions of two problematical organs of this interesting little Gasteropod.

The author has already proved the renal function of the green glands of *Astacus fluviatilis* ('Roy. Soc. Proc.', vol. 38, p. 187); also, in conjunction with Mr. Harold Follows, F.C.S., the renal function of the organs of Bojanus in Anodon ('Chemical News,' vol. 51, 1885, p. 241; 'Chem. Soc. Journ.,' vol. 48, 1885 [Abstr.], p. 921). Since the publication of those papers, Dr. C. A. MacMunn ('Journ. of Physiol.,' vol. 7 [No. 2], p. 128) has extracted uric acid from the Malpighian tubules of insects and from the nephridia of the Pulmonate Mollusca.

I. *Nephridia of Patella vulgata*.

The nephridia of *Patella vulgata* consist of two parts, left and right lobes. The left nephridium is very small in comparison to the right nephridium. The anatomy and histology of these organs have been fully described by Prof. Lankester, F.R.S. ('Ann. Mag. Nat. Hist.,' vols. 20, 1867, and 7, 1881), J. T. Cunningham ('Quart. Journ. Microsc. Sci.,' vol. 22, p. 369), and Harvey Gibson ('Edinb., Roy. Soc. Trans.,' vol. 32, pp. 617—620).

After dissecting the nephridia from the bodies of a large number of fresh limpets, the secretions of the left nephridia were examined separately from those of the right nephridia.

Both secretions were examined chemically by two separate methods as follows:—

(a.) The clear liquid from the nephridia was treated with a hot dilute solution of sodium hydrate.

On the addition of hydrochloric acid a slight flaky precipitate is obtained after standing for some time. These flakes when examined microscopically are seen to consist of small rhombic plates and other forms. On treating the secretion alone with alcohol, rhombic crystals are deposited which are soluble in water.

When these crystals are treated with nitric acid and then gently heated with ammonia, reddish-purple murexide [$C_8H_4(NH_4)N_5O_6$] is obtained which crystallises in prisms.

(b.) Another method was used for testing the secretion of the nephridia of *Patella*.

The secretion was boiled in distilled water, and evaporated carefully to dryness. The residue so obtained was treated with absolute alcohol and filtered. Boiling water was poured upon the residue, and to the aqueous filtrate an excess of pure acetic acid added. After standing about seven hours, crystals of uric acid ($C_5H_4N_4O_3$) were deposited, and easily recognised by the chemico-microscopical tests mentioned above.

The secretions both of the left and right nephridia yield uric acid. It has been suggested by Mr. R. J. Harvey Gibson, M.A., F.R.S.E. (in his masterly memoir on the "Anatomy and Physiology of *Patella vulgata*," 'Edinb., Roy. Soc. Trans.,' vol. 32, pp. 601—638), that the secretions of the two nephridia may be chemically distinct. The author could not extract or detect (after a most searching investigation) the presence of any other ingredient besides uric acid in either secretion.

From this investigation, the isolation of uric acid proves the renal function of the nephridia of *Patella vulgata*.

II. The "Liver" of *Patella vulgata*.

In a paper on the Cephalopod "liver" ('Edinb., Roy. Soc. Proc.,' vol. 13, pp. 120—122), the author proved from a chemical and microscopical study of its secretion that it possesses the function of a true pancreas or digestive organ.

Since the publication of the above paper, the author has investigated the nature of the secretions of various doubtful organs of the Invertebrata.*

The "liver" of *Patella* is a yellowish saccular gland, and the greater bulk of this organ is encircled by the superficial coil of the intestine.

- (a.) The secretion of the gland acts upon starch-paste, converting the starch into glucose-sugar, as proved by the use of Fehling's solution.
- (b.) The secretion produces an emulsion with oils and fats, yielding subsequently fatty acids and glycerol.
- (c.) When a few drops of the secretion of the gland are examined

* See Dr. Griffiths' paper, "Researches on the Problematical Organs of the Invertebrata, especially those of the Cephalopoda, Gasteropoda, Lamellibranchiata, Crustacea, Insecta, and Oligochæta."—Read before the Royal Society of Edinburgh, May 16, 1887.

with chemical reagents under the microscope, the following reactions were observed:—On running in between the slide and cover-slip a solution of iodine in potassium iodide, a brown deposit was obtained. On running in concentrated nitric acid on another slide containing a drop or two of the secretion, a yellow coloration was formed, due to the formation of xanthoproteic acid. These two reactions show the presence of albumin in the secretion of the organ in question.

- (d.) The soluble ferment secreted by the columnar cells of the epithelium of the gland was extracted according to the Wittich-Kistiakowsky method ('Pflüger, Archiv Physiol.,' vol. 9, pp. 438—459). The isolated ferment converts fibrin into leucin and tyrosin.
- (e.) No glycocholic and taurocholic acids could be detected by the Pettenkofer and other tests. No glycogen was found in the organ or its secretion.
- (f.) The secretion contains leucin and tyrosin.

From these investigations the conclusion to be drawn is that the so-called "liver" of *Patella vulgata* is similar in function to the pancreas of the vertebrate division of animal life.

XVII. "The Air of Sewers." By Professor CARNELLEY, D.Sc., and J. S. HALDANE, M.A., M.B., University College, Dundee. Communicated by Sir H. ROSCOE, F.R.S. Received May 21, 1887.

(Abstract).

Owing to the complaints which had been made of bad smells in the House of Commons a Select Committee was appointed in the spring of 1886 to inquire into the ventilation of the House. By that Committee the authors were instructed to make a series of analyses of the air in the sewers under the Houses of Parliament, and to report thereon. Since then they have examined a considerable number of sewers in Dundee, and have also made a number of laboratory experiments. The object of the research was to obtain a general idea of the amount of some of the more important impurities in sewer air, and to throw some light on their sources, and the conditions affecting their dissemination.

After giving a brief *résumé* of the results of the analyses which had been previously made of sewer air, the authors describe the methods they have employed, and the nature and condition of the sewers they have themselves examined.

As a result of their investigation they found—(1.) That the air of